

1 **CLAIMS**

2
3 We claim:

4
5 1. A heating element comprising:

6 a substrate;

7 a conductive layer disposed over the substrate to define a first
8 conductive trace and a second conductive trace with a spacer therebetween;
9 and

10 a resistive layer covering the first conductive trace, the second
11 conductive trace and the spacer, wherein the resistive layer at least partially
12 electrically connects the first and the second conductive traces.

13
14 2. A heating element according to Claim 1, wherein the resistive layer has a first
15 surface abutting the conductive traces and the spacer, and a second surface
16 opposite the first surface, wherein the second surface is at least substantially planar.

17
18 3. A heating element according to Claim 2, wherein each of the conductive traces
19 has a sidewall facing the other conductive trace, the sidewall being at least
20 substantially perpendicular to the first surface of the resistive layer.

21
22 4. A heating element according to Claim 1, wherein the spacer is made of the
23 same material as the resistive layer.

24
25 5. A heating element according to Claim 1, wherein the spacer comprises an
26 electrically insulating material selected from a group consisting of BPSG, PSG,
27 TEOS, and silicon nitride.

1 6. A heating element according to Claim 1, wherein the spacer and the
2 conductive traces have respective surfaces abutting the resistive layer, the surfaces
3 being at least substantially coplanar with respect to each other.

4
5 7. A heating element according to Claim 6, wherein the surfaces are chemical
6 mechanically polished.

7
8 8. A heating element according to Claim 1, wherein the substrate comprises an
9 insulating layer on which the conductive layer is disposed over.

10
11 9. A heating element according to Claim 8, wherein the spacer is a protruding
12 part of the insulating layer.

13
14 10. A heating element according to Claim 1, wherein the resistive layer is at least
15 substantially uniformly thick.

16
17
18 11. A fluid ejection device comprising:
19 a substrate;
20 a conductive layer disposed over the substrate to define a first
21 conductive trace and a second conductive trace with a spacer therebetween;
22 a resistive layer covering the first conductive trace, the second
23 conductive trace and the spacer, wherein the resistive layer at least partially
24 electrically connects the first and the second conductive traces; and
25 a barrier layer adjacent the resistive layer that defines a fluid chamber
26 in which fluid may be heated and ejected therefrom.

27
28 12. A printhead comprising:
29 a substrate;

1 a conductive layer disposed over the substrate to define a first
2 conductive trace and a second conductive trace with a spacer therebetween;
3 a resistive layer covering the first conductive trace, the second
4 conductive trace and the spacer, wherein the resistive layer at least partially
5 electrically connects the first and the second conductive traces; and
6 a barrier layer adjacent the resistive layer that defines a firing chamber
7 in which fluid may be heated and ejected therefrom.
8

9 13. A print cartridge comprising:

10 a fluid reservoir; and
11 a printhead fluidically coupled with the fluid reservoir, wherein the
12 printhead comprises a substrate; a conductive layer disposed over the
13 substrate to define a first conductive trace and a second conductive trace with
14 a spacer therebetween; a resistive layer covering the first conductive trace, the
15 second conductive trace and the spacer, wherein the resistive layer at least
16 partially electrically connects the first and the second conductive traces; and a
17 barrier layer adjacent the resistive layer that defines a firing chamber in which
18 fluid from the reservoir may be heated and ejected therefrom.
19

20 14. A method of manufacturing a heating element comprising:

21 forming a conductive layer to define a first conductive trace and a
22 second conductive trace over a substrate, the first conductive trace being
23 separated from the second conductive trace by a spacer; and

24 forming a resistive layer on the conductive layer to cover the first
25 conductive trace, the second conductive trace and the spacer, wherein the
26 resistive layer at least partially electrically connects the first conductive trace
27 and the second conductive trace.
28

29 15. A method according to Claim 14, wherein forming a conductive layer
30 comprises:

1 forming a conductive layer on a substrate;
2 removing a portion of the conductive layer to define the first conductive
3 trace, the second conductive trace and a void therebetween;
4 filling the void with an electrically insulating material; and
5 planarizing at least a surface of the electrically insulating material such
6 that the surface is at least substantially coplanar with corresponding surfaces
7 of the conductive traces.

8
9
10 16. A method according to Claim 15, wherein the electrically insulating material is
11 selected from a group of materials consisting of BPSG, PSG, TEOS, and silicon
12 nitride.

13
14 17. A method according to Claim 15, wherein planarizing comprises chemical
15 mechanical polishing.

16
17 18. A method according to Claim 14, wherein forming a conductive layer
18 comprises:

19 forming an insulating layer on the substrate;
20 removing portions of the insulating layer to define a protruding portion
21 flanked by two shoulder portions;
22 forming a conductive layer on the insulating layer to cover the
23 protruding portion and the shoulder portions; and
24 planarizing a surface of the conductive layer to expose the protruding
25 portion to thereby separate the first conductive trace from the second
26 conductive trace.

27
28 19. A method according to Claim 14, wherein the resistive layer is at least
29 substantially uniformly thick.